National Marine Fisheries Service
Pacific Islands Fisheries Science Center
NOAA Research Review
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Background and history of the Pacific Islands Fisheries Science Center (PIFSC).

The Pacific Islands Fisheries Science Center (PIFSC) was originally established in 1948 as the Pacific Ocean Fishery Investigations (POFI). In April 2003, the PIFSC was formally established as the sixth Science Center of the National Marine Fisheries Service and currently employs a staff of over 160 scientists and support staff. The PIFSC headquarters are located in Honolulu, Hawaii, on the University of Hawaii at Manoa campus and has a shoreside research facility at Kewalo Basin.

Over the past fifty-six years, the PIFSC has had an illustrious history of performing fisheries exploration and development, conducting fisheries research, and providing scientific information and expertise in support of the management of fisheries and the recovery of protected species in the central and western Pacific. The primary research platforms supporting PIFSC field activities include the NOAA ship *Oscar Elton Sette* and chartered vessels from the commercial industry. Today, the PIFSC continues to conduct multi-disciplinary basic and applied research on the insular, coral reefs, and oceanic pelagic living resources, fisheries, and ecosystems of the Pacific Islands and central Pacific Ocean.

Mission of the PIFSC.

The mission of the PIFSC is to conduct the science to support the stewardship of fisheries and protected species in the central and western Pacific. It is linked to the NOAA Strategic Plan Mission Goal to "protect, restore and manage the use of coastal and ocean resources through ecosystem-based management" and NOAA's Cross-cutting Priorities: 'Integrated global environmental observation and data management system', 'Environmental literacy, outreach, and education', 'Sound, reliable state-of-the-art research', 'International cooperation and collaboration', 'Organizational excellence: leadership, human capital, facilities, information technology and administrative products and services'.

Major customers of the Center.

Fisheries research activities at the PIFSC support the scientific, statistical, and economic needs of the Western Pacific Region Fisheries Management Council (WPFRMC) and international commissions for the management and conservation of large highly migratory pelagic species (HMS), including the Commission on the Conservation of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC), the Standing Committee on Tuna and Billfish of the Secretariat of the Pacific Community (SCTB), and the North Pacific Interim Scientific Committee for Tuna and Tuna-like Species (ISC). For all of these customers, the PIFSC provides scientific

information and advice to support resource management decisions and to advance our understanding of the resources and ecosystems that we are charged to managed.

Collaborative and cooperative research partners include other Federal and State of Hawaii agencies, academic institutions, foreign research institutions, government agencies of American Samoa, Guam, and the Commonwealth of the North Marianas, and the commercial fishing industry. The PIFSC is located on the University of Hawaii (UH) campus and has extensive relations with the university, resulting in significant mutual benefits. Several of the PIFSC's senior scientists hold UH adjunct professorships or senior research fellow positions, lecture UH courses in marine science and related topics, and serve as scientific advisors to undergraduate and graduate students. The PIFSC has many interactions with the UH/NOAA Joint Institute for Marine and Atmospheric Research (JIMAR) including the opportunity for PIFSC scientists to compete for funding that is awarded competitively by the JIMAR Pelagic Fisheries Research Program. In addition, PIFSC and UH/JIMAR scientists conduct substantial complementary, collaborative, and cooperative research on pelagic fisheries and coral reefs ecosystems.

Current research being conducted.

Current research at the PIFSC is conducted by five research divisions as follows:

The Ecosystems and Oceanography Division (EOD) conducts research aimed to advance our understanding of the structure and dynamics of marine ecosystems in the Pacific Islands region and the broader North Pacific. Research focuses on: (1) the role of living resources in the ecosystem and (2) how these resources might respond to change, both on the local scale (e.g., predators or prey availability) and on broader time and space scales (e.g., ocean climate change). The EOD's multidisciplinary projects allow for collaborative research with other Center Divisions, agencies, and academia, and address ecosystem, environment, and anthropogenic impacts for a range of species including the Hawaiian monk seal, several species of sea turtles, and highly migratory species including tunas, billfishes, and other incidentally harvested species. The EOD's current research geographically ranges from regional studies (e.g., the monk seal foraging studies and precious coral resources around the Hawaiian Archipelago) to global studies (e.g., climate indices or North Pacific basin-scale oceanography and the relationships to living resources). Temporally, studies range from short term (0-2 years) (e.g., movement studies of pelagic animals using satellite archival tags) to longer term (>5 years) (e.g., influence of climate regimes on fish catches).

The Fish Biology and Stock Assessment Division (FBSAD) conducts state of the art research related to the population biology, stock assessment, ecology, and life history of exploited resources and associated species (e.g., prey, bycatch, and protected species) in the central and western Pacific. The FBSAD integrates biological, ecological, oceanographic, and economic data to advance stock assessments and to advise resource management at both species and ecosystem levels while addressing mandates of the Magnuson Stevens, Endangered Species, Marine Mammal Protection, and Migratory Bird Treaty Acts. Research programs emphasize population modeling, resource survey

cruises, experimental fishing, determination of vital rates and other life history parameters, environmental physiology, distributional ecology, and mitigating fishery interactions with protected species. Again, research projects range geographically from the local scale (e.g., studies on insular fishery resources – lobsters, bottomfishes) to global scales (e.g., population and stock assessments of Pacific wide highly migratory pelagic species (HMS)). Temporally, short term studies include fishing and bycatch mitigation experiments, medium term (2-5 years) studies include many of the life history age and growth, reproduction, and recruitment studies, and over the long term, studies such as the international population assessments of HMS species. Increased number of new indicators of climate impacts on marine ecosystems

The Coral Reef Ecosystem Division (CRED) conducts multidisciplinary ecosystem-based research and monitoring that provides the scientific basis for effective management and conservation of coral reef ecosystems in the U.S. affiliated islands of the central and western Pacific Ocean. Specific research activities include: (1) ecological assessment and monitoring to quantify and document spatial and temporal changes in the health of coral reef living resources due to natural or human induced impacts; (2) habitat mapping and characterization to define and understand the dynamics of habitat ecosystem resource linkages; (3) monitoring of oceanographic processes affecting reefs to monitor conditions that influence coral reef ecosystem health; and (4) reef restoration through the assessment, monitoring, and mitigation of the effects of marine debris on coral reef ecosystems. Complementary applied research include: evaluating the effectiveness of marine protected areas (MPAs), evaluating impacts of fishing gear on essential fish habitat, and improving assessment and monitoring techniques for commercial bottomfish populations. Coral reefs research is generally conducted on the regional scale (Hawaiian, Samoan, and Marianas Archipelagos and remote Pacific Island areas, however, approaches, concepts, solutions, and discoveries are often applicable to coral reefs throughout the world. Research is conducted on varying time scales ranging from discrete studies of faunal composition to long term studies on impacts of climate change on coral reefs ecosystems, e.g., coral bleaching.

The Protected Species Division (PSD) conducts scientific investigations which serve as a basis for management actions to enhance the conservation and recovery of endangered Hawaiian monk seals and endangered and threatened sea turtles. The PSD is comprised of two programs, the Marine Mammal Research Program and the Marine Turtle Research Program. Research objectives for both programs addressed species-specific topics designed to assess and monitor population trends, characterize biology and natural history, understand foraging ecology and movement patterns at sea, identify and investigate impediments to population growth, and build research capacities with other stakeholders. The PSD also conducts community outreach and education activities to gain stakeholder support and promote the stewardship of protected species. Research on Hawaiian monk seals geographically is highly regional and limited by and large to the Northwestern and Main Hawaiian Islands. Sea turtles research can be regional (e.g., green sea turtles) or global (e.g., distribution, migration, life history of migratory species such as leatherback, olive ridleys, and loggerhead turtles).

The Fishery Monitoring and Socioeconomics Division (FMSD) is the focal point for fisheries dependent data collection and economic and operational research for the PIFSC. This Division collects, quality controls, and processes fishery-dependent information (i.e., logbooks), issues quarterly and annual reports (including longline, bottomfish, and lobster), and conducts socioeconomic research on Federally managed fisheries. Also residing in the FMSD is the Western Pacific Fisheries Information Network (WPacFIN) that collects and processes Pacific Islands' agencies data (Territories of Guam and American Samoa, Commonwealth of the Northern Mariana Islands, and State of Hawaii) and also provides technical support to develop and implement appropriate data collecting, processing, summarizing, analyzing, and report-generating systems for these island agencies.

Major accomplishments in the last five years.

Discovery and description of the North Pacific "Transition Zone Chlorophyll Front".

Pelagic ecosystem dynamics on all temporal scales may be driven by the dynamics of very specialized oceanic features. One such feature the was described by PIFSC scientists is the basin-wide chlorophyll front located at the boundary between the low and high chlorophyll subtropical gyres. Global satellite maps of surface chlorophyll clearly show this feature in all oceans. In the Pacific, the front is over 8,000 km long and seasonally migrates north and south aout 1,000 km. In the winter it is located at about latitudes 30°-35°N and in the summer at about 40°-45°N. Since this chlorophyll front moves seasonally between the southern and northern limits of the Transition Zone, it was named the Transition Zone Chlorophyll Front or TZCF. Satellite telemetry data on movements of loggerhead turtles, Laysan albatross, and detailed fisheries data for North Pacific albacore tuna indicate that all of these species forage at this front and in some cases travel along it as they migrate across the North Pacific. The front is easily monitored with ocean color satellite remote sensing. Interannual variation in the position and strength of the TZCF has been observed and appears to have impacts on marine resources. Results describing the TZCF and relationships with living resources have been published in a number of peer review journal articles, notably, Fish. Oceanogr. 9:71-82 (2000), Prog. Oceanogr. 49:469-483 (2001).

Redefined critical foraging habitat for Hawaiian monk seals and link to precious coral beds.

Observed starvation and declining survivorship of seals at French Frigate Shoals (FFS) Atoll in the Northwestern Hawaiian Islands prompted a study of seal foraging habitat. In 1995, in collaboration with National Geographic Television, the PIFSC began to study monk seal foraging habitat using preprogrammed video recorders - "CRITTERCAMs." Initial work found that adult seals ignored fish communities associated with shallow coral reefs and instead focused on cryptic fauna (fish and

invertebrates) on the deep slopes (50-300+ m) of the atoll and neighboring banks. The seals most actively foraged in the transition zones where loose rock fragments border areas of sand. Adults were observed to swim from one rock to another, flipping each and eating the fish and invertebrates hiding underneath. Subsequent CRITTERCAMs were modified to record images in the dark and documented nocturnal feeding on eels in patches of deepwater coral. With the advent of smaller camera systems, instrumented juvenile monk seals (yearlings) were documented to dive to the same deep slope sites that adults frequented for feeding. Unlike adults, the juveniles did not spend their time flipping large rocks to get fish, but rather spent their time searching fields of sand for flatfish, eels, and octopus. In collaboration with the Hawaii Undersea Research Laboratory, the research further expanded to employ the submersibles *Pisces V* and *RC-150* to survey the bottom at two deep sites (300-500 m) at FFS where previous studies using satellite telemetry indicated that FFS seals frequented. Both sites were found to support precious coral beds including gold coral that are known to grow to more than 100 cm. These findings have refocused research today on thee role of deepwater corals and their importance as fish habitat. Of particular interest are fish species that are likely prey for monk seals when foraging at these deeper slope habitats.

Completed stock assessments for several pelagic highly migratory species.

Studies on the population status of several highly migratory species (HMS) including swordfish, blue sharks, yellowfin and bigeye tunas and blue marlin, were completed providing up-to-date information for the management of the Hawaii-based longline fishery. Assessments of North Pacific swordfish and blue shark indicate that both populations are sustainable given current fishing pressure; however, a Pacific-wide blue marlin assessment indicates that the population may be close to a fully exploited state.

Completed extensive baseline ecological assessments for coral reef ecosystems in the central and western Pacific.

In collaboration with NOAA coral matrix partners, baseline ecological assessments of fish, corals, algae and other invertebrates, benthic habitat mapping, oceanographic surveys, and establishment of an array of monitoring stations have been completed for coral reef ecosystems in the Northwestern Hawaiian Islands, Territories of American Samoa and Guam, the Line and Phoenix Islands, and the Commonwealth of the Northern Marianas. The coral reef ecological assessment and monitoring goals which continue to today are to: (1) document baseline conditions of the health of coral reef living resources in the U.S. Pacific Islands, (2) refine species inventory lists of these resources, (3) monitor these reef resources over time to quantify possible natural or anthropogenic impacts, (4) document natural temporal and spatial variability in the reef resource community, and (5) improve our understanding of the ecosystem linkages between and among species, trophic levels, and surrounding environmental conditions.

Legal mandates for the research in the center.

- Coral Reef Conservation Act of 2000
- Magnuson-Stevens Fishery Conservation and Management Act
- Endangered Species Act
- Marine Mammal Protection Act
- Marine Protected Area Executive
- Migratory Bird Treaty Acts.
- NWHI Coral Reef Ecosystem Reserve Executive Order